Job Loss Analysis

ID No: 2000070 **Status:** Closed **Original Date:** 13/Apr/2010
Last Review Date:

Organization:

SBU: GMfg
BU: Global Mfg Shared
Work Type: GMfg Manufacturing Shared (Process Engineering)

Title (Work Activity): Process Engineering Relief Valve Sizing

Personal Protective Equipment (PPE)	Selected	Comments
Proper PPE per your Refinery Guidelines	Y	

Site/Region:

Reviewers

Reviewers Name	Position	Date Approved
Michelle Johansen	Process Engineering Manger RI Refinery	13/Apr/10

Development Team

Development Team Member Name		
Malcolm White		Process Engineering Manager
Joe Ninneman		Lead Process Engineer
Gary Neville		Lead Process Engineer
Andy Waterman		Lead Process Engineer
Laura Edwards		Process Engineer
Bryony Jones		Process Engineer
Declan Carey		Process Engineer
Elen Jones	X	Process Engineer

Job Steps

No	Job Steps	Potential Hazard	Critical Actions
1.	**Safety Relief Valve Data Sheet Availability.**	1. Existing Data Sheet may no longer be valid, e.g. Plant may have been modified. 2. Existing data sheet may be unavailable or the new safety relief valve being designed is for a brand new service.	1. Determine the size and type of relief valve installed and check against the data sheet. 2. Generate a new Pressure Safety and/or Vacuum Relief Valve Data Sheet.

2.	**Determining relief load.**	1. Failure to identify potential scenarios for relief loads. 2. Failure to capture the largest relief load, potential for relief valve to be undersized. 3. Incorrect type of relief valve, e.g. balance bellows instead of conventional valve.	1. For each pressure relief location, relief loads that result from one of the potential causes listed in FRS-DU-5057B Section 23.1 shall be listed. 2. If a relief valve has multiple relief cases, the relief valve shall be sized per the case which results in the largest orifice area. 3. Ensure back pressure calculation has been conducted. Review FRS-DU-5057B Section 18 – Selection of Pressure Relief Device.
3.	**Review Relief Valve Location and Type Required.**	1. Relief valve incorrectly located. 2. Incorrect type of relief valve in place. 3. Incorrect type of relief valve, e.g. Balance bellows instead of conventional valve. 4. The correct valve trim for liquid, vapour or 2 phase relief, to prevent damage to valve due to chattering or high blowdown of the valve.	1. Review FRS-DU-5057B Section 5 for Pressure Relief Valve Location Requirements. 2. Review FRS-DU-5057B Section 6 and 12 for Temperature Relief Valve and Vacuum Relief Protection Requirements. 3. Ensure back pressure calculation has been conducted. Review FRS-DU-5057B section 18 –Selection of Pressure Relief Device. 4. Refer to FRS-DU-5057B Section 18.1 for liquid, vapour or 2 phase relief valve trim.
4	**Sizing Pressure Relief Valve**	1. Incorrect formulae used to determine the relief valve capacity. 2. Incorrect relief valve nozzle effective area selected.	1. Review Section 5, FRS-DU-5056C – Pressure Relief Valve Capacity Formulae. Select the applicable formulae. 2. Review Section 5.1, FRS-DU-5056C – Pressure Relief Valve Nozzle Effective Areas. Select applicable nozzle size. 3. Check orifice size versus calculated size to confirm sufficient area for Swagelok type.

5	**Reviewing the Flare Loads**	1. Flare load incorrectly determined. 2. Current flare system not designed for additional load.	1. Review FRS-DU-5057B Section 24 - Flare Loads for Flare System Sizing 2. Review the determined flare load with Process Technology Department – Process Technology will examine the following: ▪ The back pressure effect on the pressure relief valve capacity. ▪ The impact on the flare header capacity – particularly for site wide conditions such as steam or power failure. ▪ The requirement for stress analysis in the case of high temperature relief. ▪ Design features that may be necessary to limit or mitigate relief load. ▪ Pipe roughness has been used for hydraulic calculations. ▪ Check pipe stresses for two phase flow.

6	**Data Sheet Completion**	1. Incomplete or incorrect data sheet preventing engineer from purchasing the correct valve.	1. Complete the relevant fields in the Site Standard Data Sheet. Namely: • Required relief capacity • SG at relief conditions • Compressibility factor • Ratio of specific heats • Operating/ relief temperatures • Corrosive material • MAWP • Set Pressure • Vacuum Setting • Cold set pressure • Allowable accumulation • Super imposed back pressure • Calculated orifice area • Selected Orifice Area • Selected Orifice Area/ letter • 'Pop Open' relief rate • Inlet line ΔP as a % of set pressure @ pop open relief rate. FRS-DU-5057-B 19.6. for the difference between vapour and liquid load. • Outlet line ΔP as a % of set pressure @ required relief rate. Refer to FRS-DU-5057-B 16.7 for the difference between vapour and liquid and valve type. All fields can be determined using formulae from FRS-DU-5057B&C
7	**Data Sheet Verification**	1. Incorrect calculations/ data sheet incorrectly completed ultimately resulting in the incorrect relief valve. 2a. Excessive inlet line pressure losses may result in relief valve chatter / damage or destruction. 2b. Excessive outlet line pressure losses may result in sonic flow / reduced relief valve capacity. 3. Incorrect assessment of potential two phase flow will result in undersized relief devices / connecting piping. 4. Flashing liquids (LPG) may result in cold embrittlement and subsequent failure of relief piping	1. Relief valve calculations to be checked by a Process Engineer, and approved by a Designated Process Engineer. 2. Pressure drop data on inlet and outlet should be checked by a designated Process Engineer to assure correct assumptions. 3. Determine if two phase flow is occurring and assure relief valve is designed correctly for this condition. 4. If liquid is flashed across valve during relief, determine outlet line temperature to assure failure is not possible with design.

8	**Cross Check Manufacturer's Valve with Original Data Sheet**	1. Buyer purchased incorrect valve.	1a.Cross check Vendor's Data Sheet with the original Data Sheet. 1b. Confirm vendor's material of construction is suitable for the intended service. Refer to FRS-DU-5056-C, Section 8 – Materials for Pressure Relief Valves.
9	**Documentation**	1a. Operating Manuals/ Plant Files not updated. 1b. No record of the relief calculations/ data sheet. 2.Flare System Process Summary and Flare PFDs not updated.	1. Relief calculations and data sheet to be documented as per FRS-DU-5057B&5056C Section 26 – Documentation. Typical documentation includes: • Updating Operating Manual/ Plant Files. • Sketch of the unit and offsite flare system. • Detailed calculations for all applicable scenarios not just the sizing case. 2. Assure designated engineer and system such as MOC is in place to keep the Flare System Process data and Flare PFDs up to date.